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Tidal Wave of Wiring Requirements to Hit Industry

Safety impact, pace of progress, debated at task force meeting

WIRING INSPECTIONS COCKPITS, E&E BAYS, POWER FEEDER CABLES AN FAA-SUGGESTED TIMELINE		
Aircraft Age Category	**Start Date**	**No. of Aircraft (% of Fleet)**
> 20 years old	Jan. 2006	1,339 (19%)
15-20 years old	Jan. 2007	711 (10%)
10-15 years old	Jan. 2008	1,509 (21%)
5-10 years old	Jan. 2009	1,278 (18%)
< 5 years old	Jan. 2010	2,316 (32%)
		Source: ATSRAC

A combination of regulatory and research activity is about to change the landscape for aircraft wiring. The potential impact in the next few years may be likened to a tsunami. The costs are largely unknown. The benefits have been characterized by supporters as substantive and significant but grossly insufficient by skeptics.

A classic debate along the lines of "Is the glass half full or half empty?" took place at last week's meeting of the **Aging Transport Systems Rulemaking Advisory Committee** (ATSRAC). The meeting, convened to cap some three and a half years of work to improve the safety of aircraft wiring, was held just a week short of the sixth anniversary of the fatal July 17, 1996, explosion of **TWA** Flight 800. Critics believe the wiring inspection program that was outlined falls short, calling only for enhanced visual inspections of a limited portion of aircraft wiring, and that it will not be until 2010 before fleetwide wiring inspections begin in earnest. These inspections would not be completed until some 15 years or more after the TWA disaster.

That's the negative view.

The positive view is that the program envisioned last week represents a long-term, systemic effort to assure safety of aircraft wiring. As such, it goes beyond the high-priority and targeted actions taken to date.

"I know it's been so many years since TWA 800, but we're imposing an awful lot on the operators," said Charles Huber, the **Federal Aviation Administration** (FAA) official who serves as ATSRAC executive director.

Ric Peri, vice president of government affairs for the **Aircraft Electronics Association**, was among those who noted that most of the immediate and acute wiring safety issues have been addressed through airworthiness directives (ADs) and, for fuel system wiring, by SFAR 88, which lays out a three-year program targeted directly at electrical components in fuel systems *(see ASW, May 14, 2001, p. 1)*.

The ATSRAC program, Peri said, "Is the last piece of the puzzle, and it's not unrealistic that it should take 15 years."

Operators are facing a mandated program of wiring inspections that could cost the industry anywhere from $100 million to a quarter-billion dollars or more. This estimate depends upon how the costs shake out for new inspections requiring 400 or more man-hours to complete on a fleet of 7,000 aircraft. According to an FAA-suggested timeline, more than 7,000 aircraft would undergo inspections starting in January 2006 *(see box, above)*. These inspections would focus on three areas deemed critical: wiring in the cockpit, wiring

Wiring System Defined

EWIS: Electrical Wiring Interconnection System

"An electrical connection between two or more points including the associated termination devices (e.g., connectors, terminal blocks, splices) and the necessary means for its installation and identification."

- **EWIS *includes*:**
  - Wire (e.g., wire, cable, coax, databus, feeders, ribbon cable)
  - Circuit protection devices
  - Contacts and connectors
  - Electrical grounding
  - Splices
  - Conduits, clamps, supports
  - Shields or braids
  - Wiring inside shelves, panels, racks, distribution panels, etc.
- **EWIS *does not include*:**
  - Fiber optics
  - Wiring inside avionics equipment
  - Portable, carry-on, or otherwise non-permanently mounted (not part of the certification basis) electrical equipment

Source: AC No. 120-XX, Program to Enhance Aircraft Electrical Wiring Interconnection System Maintenance, July 5, 2002, DRAFT ■

in the electronics and equipment (E&E) bay, and power feeder cables.

The inspections would unfold in phases, in order from oldest to youngest aircraft. All told, more than 7,100 aircraft would be involved – these are turbine-powered, transport-category aircraft carrying 30 or more passengers and weighing 7,500 pounds or more. As such, the sweeping wiring safety program will impact scheduled passenger carriers, cargo operators, regional airlines, charter carriers – any operator of an aircraft falling within these parameters.

Stringent wiring inspections of other zones beyond the E&E bay, the cockpit, and power feeder lines in the aircraft will be mandated to occur on a regular basis.

The ATSRAC program outlined last week comes at a time when questions are being asked as to whether the FAA and the industry can implement timely corrective action for a known hazard to safety. At a recent aircraft wiring working group symposium an official with the **National Transportation Safety Board** (NTSB) noted the sixth anniversary of TWA 800 and the bad wiring found on other high-time jets during the course of the accident investigation, lamented that, "We're going out, looking at airplanes, but we're not seeing the [positive] changes that we should." *(See boxes, p. 3)* This NTSB official applauded **Northwest Airlines** [NWA], which he said is "preemptively replacing wiring in selected areas." He noted the operational benefit, in terms of improved dispatch rates, when wiring associated with autopilot and antiskid systems is in sound condition. **Swiss**, formerly **Swissair**, also has embarked on an aggressive and costly program to upgrade wiring in its MD-11 fleet.

This NTSB official contended the wiring issue represents a real test of the industry's willingness to change.

The ATSRAC effort is the primary vehicle of change; whether the program it envisions goes far

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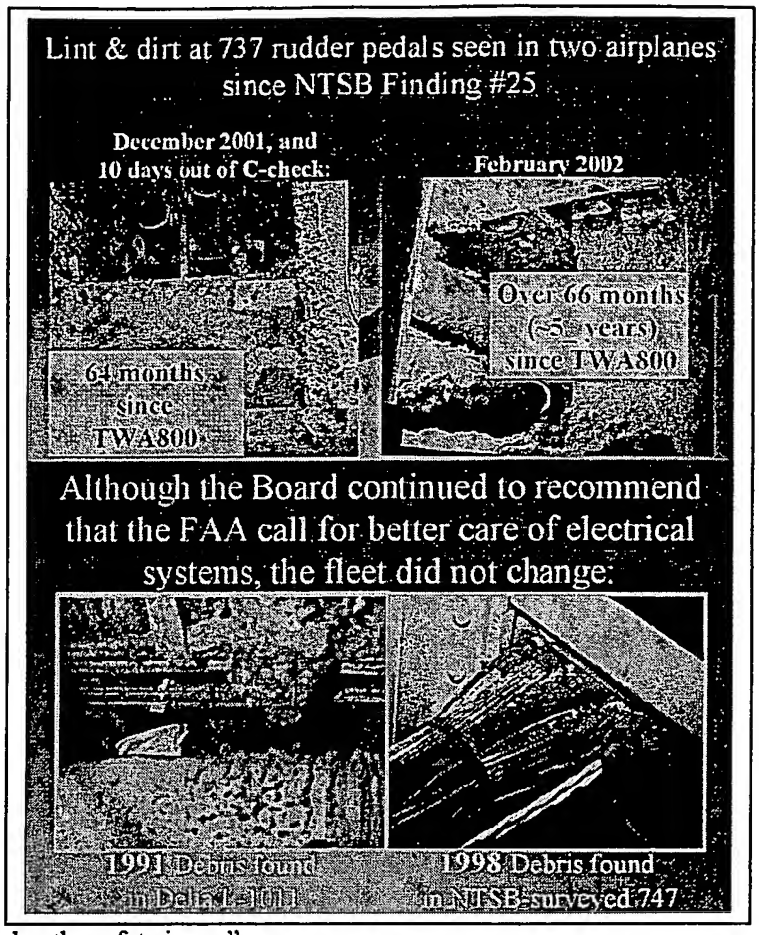
enough for a total solution to wiring system flaws is the issue debated last week. That program features a number of interrelated elements: improved training, improved standards, tightened regulatory standards, and more comprehensive inspections in the field, to cite just a few key elements.



Training

"The underlying issue is that nobody pays attention to wiring; it's part of the underlying landscape," said Spencer Bennett, an official with **Federal Express**, who spearheaded the working group tasked to develop an enhanced training program for wire system maintenance.

That training program, Bennett said, will be spelled out in an advisory circular (AC). "I believe we've designed a good training program that anyone can pick up and utilize at their airline," he said.

"Proper training will reduce the damage as a result of neglect, wrong wiring installations and improper wiring repairs," Bennett explained.

Peri countered, "Training someone to correctly install bad insulation does not solve the safety issue."

"If the design is flawed, it's going to be installed flawed," he added.

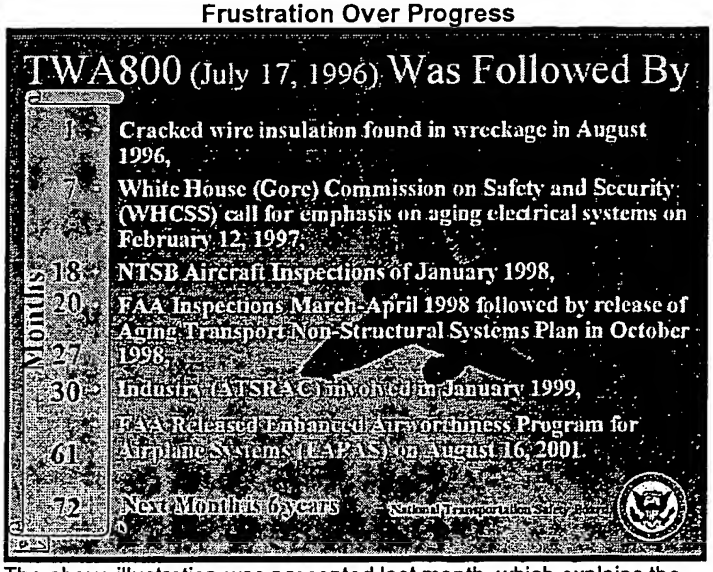
Vic Card, representing the UK's **Civil Aviation Authority** and Europe's **Joint Aviation Authorities** (JAA) said, "We've found something that's inadequate, and we address it with an AC. That's a non sequitur."Card was referring to the fact that ACs are not mandatory.

Bennett replied that the forthcoming AC is "one means of complying with FAR [Federal Aviation Regulations] Part 121 that mechanics must be trained."

One attendee quipped that the FAA says in effect, "You all will have a training program." The AC, he said, is tantamount to saying, "Be careful, you hear?"

There is an added dimension. The training will be geared to attain greater compliance with manuals issued from the manufacturer. However, these manuals and the associated training programs are "accepted" by the FAA. They are not "approved" by the FAA. Acceptance, it was explained, is an acknowledgement that a document

Frustration Over Progress



The above illustration was presented last month, which explains the reference to the TWA 800 sixth anniversary "next month."

exists. "When an FAA inspector approves it, he's responsible for its contents," this source explained.

In other words, the training will be published in a non-binding AC to ensure better compliance with procedures the FAA has only acknowledged, not approved.

Improved standards

One thing seems to be widely acknowledged within the industry: the 60° flame test, the FAA's only standard to qualify wire for installation, is obsolete. The standard does not test wire for its tendency to smoke or to give off toxic (and potentially lethal) gases. A new technical standard order (TSO) is mired in development, its publication remaining some two to four years into the future. In the meantime, there is no regulation preventing the installation of wiring with a known tendency to give off copious quantities of smoke and dangerous gases when burned. Nor are there requirements to test wire for these properties when it is powered with current, a deficiency noted by investigators with the **Transportation Safety Board** (TSB) of Canada.

Jim Shaw, an ATSRAC official representing the **Air Line Pilots Association** (ALPA), said, "ATSRAC needs to communicate to the FAA that smoke and toxicity standards must be developed."

New regulations

Nonetheless, some 28 new rules, in which eight existing rules will be modified, are to be incorporated into FAA and JAA airworthiness requirements. In the applicable United States FARs, a new Sub-Part H will consolidate much of the regulatory material into a new section entitled "Electrical Wiring Interconnection System," or EWIS *(see box, p. 2)*.

As an example of the kind of language forthcoming, consider this separation standard:

> "A fault in any one airplane power source EWIS will not adversely effect any other independent power sources. The physical separation must be achieved by separation distance, barrier, or other means shown to be at least equivalent."

Now consider the language as it applies to fuel systems:

> "The EWIS must be designed and installed with adequate separation distance or barrier from fuel lines and other fuel system components."

Note absence of any provision for "equivalent other means."

An ATSRAC official explained, "The team specifically wanted distance or a barrier, *not* an equivalent or alternate method."

In the draft regulations, one sentence did not make the cut:

> "In the event of failure, no hazardous quantities of smoke, toxic, or noxious products will be distributed in the crew and passenger compartment."

ATSRAC members voted 12-5 to delete this sentence. Part of the rationale is that more detailed specifications are under development at the FAA's Technical Center. There also is a matter of trade-offs that may warrant more consideration. "Would you accept a more flammable material if it gave off less toxic gas?" asked Chris Smith, an FAA scientist. To those like Smith who work these issues on a daily basis, the trade-offs are not trivial.

Nevertheless, when the full ATSRAC committee voted to delete the sentence, one official on the working group who developed the regulatory language exclaimed disappointedly that a year's worth of effort to develop the language was sheared off at a stroke.

One reason for the deletion has to do with terminology. For example, what does "failure" mean? It could be anything from an arc to an uncontained fire.

An overarching strategy seems to apply: the regulatory language will outline "what" needs to be done; a related series of ACs will outline the various means of "how" the standards are to be achieved. The ACs lay out the rationale in a brief review of the history of wire problems. Draft language pointing to the hazard of mixing wire types, to intrusive inspections that found .44 to 3.62 insulation breaches per 1,000 feet of wire, and the finding that wire type mattered (e.g., Kapton led the pack for problems), were among the concerns cited *(see ASW, March 19, 2001, p. 4 box and p. 5 box)*.

"We need to keep the histories comparable among the ACs," an ATSRAC member urged. Rather than convene what might be called a "history harmonization group," the FAA will be detailed to write a consistent history for inclusion in the ACs.

Two standards

Details of the forthcoming enhanced zonal inspections of aircraft wiring are contained in one of the ACs. Architects of this document said the program it outlines has two purposes: to ensure that a single arc does not ignite a fire, and that a single arc does not cause loss of a critical flight control.

The document lays out a new standard for a general visual inspection (GVI). The new definition adds proximity, e.g., within touching distance, and allows for the use of a hand-held mirror. It does not require equipment to be removed or moved for the wire to be inspected. It does not require disassembly of wire bundles to inspect the inner circuits. However, the addition of "within touching distance" and the use of a mirror substantially alters the generally accepted understanding and practice today of general visual inspection (GVI).

Wiring modifications to in-service aircraft present a major challenge. The draft program features one standard for service bulletins (SBs) issued by manufacturers and another for modifications performed per supplemental type certificates (STCs). STC work would include such things as logo lights or cabin entertainment systems installed by repair stations.

The failure of each load path must be considered individually, for every modification going back to 1958, if the airplane is that old. That's a very tall order. According to one account, Boeing has issued more than 48,000 SBs for all of its aircraft and their systems.

The number of STCs granted to repair stations, operators and other companies also runs into the tens of thousands, perhaps more, because nobody knows for sure. Each and every wire for each and every change would have to be assessed to determine if its failure could affect the performance of other wiring in a particular zone. Indeed, any wiring installed per an STC that is subject to contamination falls under the requirement. Even if contamination is not considered, the wording is such that a repair station would have to go through its archive of every STC it was issued to determine if the wiring comes under the Enhanced Zonal Analysis Procedure (EZAP).

As one ATSRAC attendee remarked, "There isn't enough money in the Federal Reserve to do this."

However, ATSRAC officials suggested this work may not be as burdensome as it first appears – the work applies only to turbine-powered aircraft weighing 7,500 pounds or more and carrying 30 or more passengers, they said.

Repair stations may still recoil at the requirement, since it likely will appear as a double standard to some. Type-certificate (TC) holders, which is to say the aircraft manufacturers, are to be exempted from this circuit-by-circuit analysis for wiring modified by service bulletins. Randy Boren, a Northwest Airlines official who headed the task force that developed these criteria, explained, "There is a feeling that it is more likely that STC wiring was improperly installed than for a service bulletin."

"A lot of STCs were approved, some without instructions for continued airworthiness, or some with no installation instructions," he added.

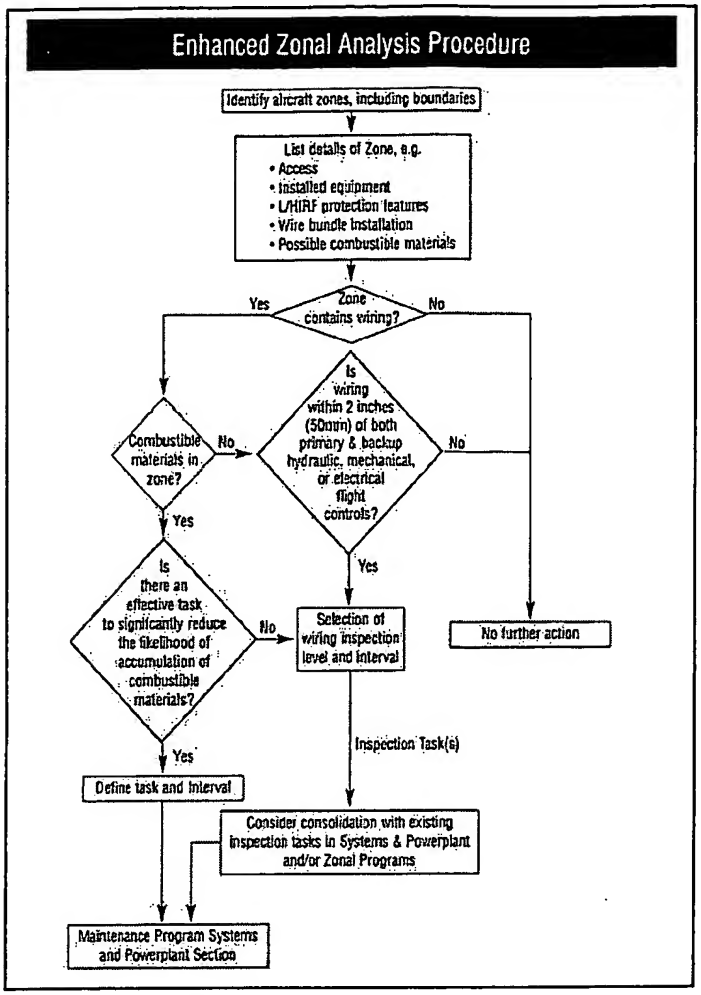
"We are requiring the STC holder to look at the installation, to see if it would appreciably effect the zone," he explained.

Enhanced zonal inspections

The heart of the EZAP process is outlined in a flow chart *(see box, top, p. 6)*. This chart applies to the first-order call to inspect wiring in the cockpit area, the E&E bay and power feeder cables. But, more importantly, it lays out the analytical approach to determining what other wiring in the aircraft must be inspected. As shown, the goal is to eliminate combustible material, such as lint, flammable thermal acoustic insulation, or other material. If otherwise clean original or modification wiring is within two inches of primary or backup flight controls, it comes under the EZAP umbrella for enhanced GVI.

By carefully walking through the flowchart, it is evident that wiring in high-stress areas (heat, vibration, etc.), in areas of heavy maintenance (where wiring problems are known to be chronic), and in severe wear and moisture prone (SWAMP) areas may not require inspection. By process of exclusion, a significant amount of wiring will not come under the EZAP regime.

Take the case of Swissair Flight 111, which crashed in 1998 from a spreading fire in the area over the forward galley and cockpit. The discovery of burned, metalized Mylar thermal acoustic insulation material in



the accident aircraft, an MD-11, led to a huge and costly program to remove this material from some 700 aircraft. However, under the EZAP program outlined last week, the material in this zone would not require enhanced inspection because the material was not considered combustible at the time the airplane was certified. Thus, other aircraft with insulation materials that do not pass the FAA's new radiant heat/direct flame test – developed as a direct outgrowth of the Swissair Flight 111 tragedy – would not require enhanced zonal inspections, according to ATSRAC officials.

Timetable

Officials hope to publish a final rule sometime in 2004. Operators and repair stations would have 12 months from the rule's date to implement a new wiring system training program. They would have another 12 months to derive their EZAP inspections (ATSRAC suggested 24 months, the FAA is considering 12 months for this part of the process). As a rough approximation, actual inspections would commence around January 2006 for aircraft more than 20 years old.

Cost benefit hurdle

All of this activity must pass muster with the **Office of Management and Budget** (OMB). More particularly, it must pass the test of a cost-benefit analysis. According to an FAA official, an accident can only be used once to justify a safety program. Thus, the TWA 800 crash was used to justify the fuel tank safety program outlined in SFAR 88. Even though problems were found with corroded, cracked, and contaminated wiring in other aircraft systems, the TWA Flight 800 crash cannot be used again by the FAA as further justification for its rulemaking. Similarly, the 1998 crash of the Swissair jet was used to justify the thermal acoustic insulation blanket removal program the FAA mandated. It can't be used again. Instead, the FAA hopes to use 20 years of wiring-related incidents, service difficulty reports (SDRs) and accidents that haven't been claimed in other rulemaking to justify this new program.

The effort to make the case will be hobbled by database deficiencies. The SDR database does not feature a specific code to record wiring problems, and reporting discipline among airlines varies considerably, the justification effort is crippled by inadequacies in the database.

Related research

Meanwhile the FAA and the **U.S. Navy** have embarked on a joint program to develop an arc fault circuit breaker (AFCB). Conventional thermal breakers may not trip in time to prevent severe arcing damage to aircraft wiring. For this reason, an AFCB with embedded software is seen as a means of cutting power as a wire begins to fail, and before the failure develops into a full-blown arc that chars insulation, melts conductor, and creates general mayhem in a wire bundle.

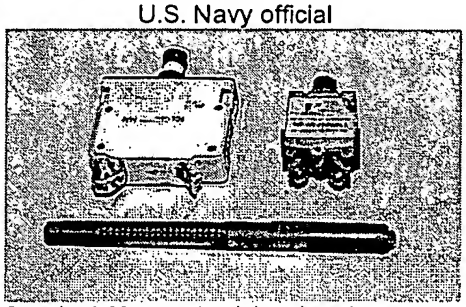
The joint FAA-Navy effort has successfully shrunk the size of the AFCB to one that would fit in an aircraft circuit breaker panel *(see photo, p. 7)*. A series of eight AFCI's are now installed on an FAA B727 flying test bed to evaluate their reliability under actual flight conditions. The objective is to accumulate 50 hours of instrumented flight experience. "We want to capture the waveform and assess whether the problem

was the AFCB or in the aircraft," said one of the engineers involved during a recent demonstration aboard the aircraft at the Naval Air Station, Patuxent River, Md.

"We're evaluating nuisance tripping in a real-world environment," he explained. "We want to make sure when the radar and coffee pot are turned on that we don't get a trip."

The AFCBs under development will be more expensive than conventional circuit breakers (CB). An existing aircraft CB costs in the range of $30 to $50. The AFCB is expected to be three to five times more costly, in the range of $150. "You have to weigh the cost of this AFCI against the cost of rewiring the aircraft," said a program official.

'We've Met the Size Goal'
U.S. Navy official



Standard 50 amp circuit breaker shown at left. New arc fault circuit interrupter (AFCI) in development shown at right. This is a 2.5 amp device, but project engineers say a 15 amp AFCI comes in this size, and they anticipate a 25 amp AFCI can fit in his size as well. *Photo: U.S. Navy*

The **Boeing** [BA] Phantom Works has an even more advanced AFCB under development. It is not as close to an operational product as the FAA-Navy effort, but Boeing's solution includes a built-in time domain reflectometer (TDR) that is capable of inhibiting power on a circuit if a potential short exists. If a fault does occur, the TDR kicks in and records the point at which it occurred on the wire *(see box below)*. A source familiar with this project lauded Boeing's approach. "They take a footprint of the integrity of the wire when the breaker is installed. Each time the circuit is powered up, the TDR takes a look to see if conditions have changed. If there is an anomaly in the waveform, the circuit will not power on," this source explained. Obviously, such a TDR device would be desirable for all wires in the aircraft. This would be easiest for new-production aircraft, but if installed in all new aircraft it could serve as a built-in test device to check the integrity of all the wiring. Anomalies could be further validated or checked by a ground support tester that would look more closely at any flags that such a device would set to alert maintenance personnel.

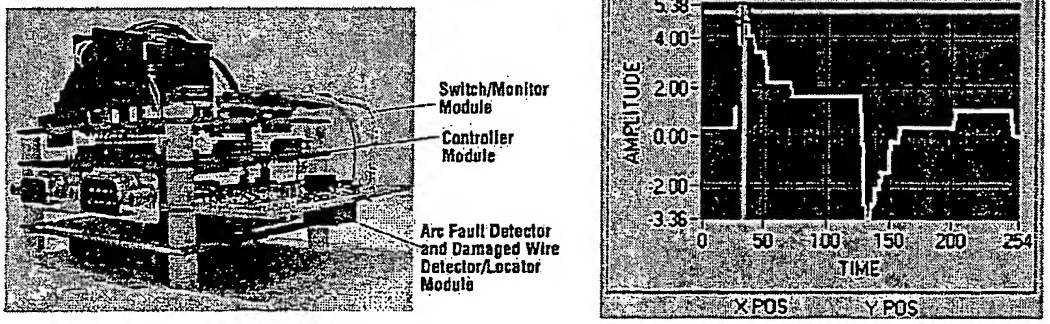
Meanwhile, several airlines are flying AFCBs on non-critical systems during ferry flights and are giving rave reviews. **Delta Airlines** [DAL] is working to get a preliminary flight clearance so it can start evaluating AFCI technology on revenue flights.

Even though AFCBs are more costly, their potential to reduce costs is one of the great hopes. "We're spending a lot of time trouble-shooting wiring faults, in the Navy," said Bob Ernst, head of the Navy's aging aircraft program. With AFCB technology, Ernst said, "We can reduce wiring-related trouble-shooting by 20 percent, because we'll be able to isolate the faults."

The good, the bad, the missing

AFCB technology, of course, is not a panacea for faulty wiring – it is literally a means of

Boeing Phantom Works Arc Fault Programmable Circuit Breaker With Damaged Wire Detector/Locator



Above left, the high-tech arc fault circuit breaker under development at Boeing's Phantom Works. Above right, a display from the maintenance test interface, showing that a short circuit has been located approximately 12.5 feet down a 50-ft. wire with load.
Source: Boeing

shortstopping wire failures before they create significant damage. These high-tech circuit protection devices do not address the significant number of wiring breaches found in the half-dozen airplanes subjected, since TWA 800, to intrusive wiring inspections.

On the other hand, those inspections, conducted under the aegis of ATSRAC, settled the debate that damaged wiring existed in the fleet. At last week's meeting, that was no longer an issue.

Other issues remain. These immediately come to mind: (1) the time it's taking, (2) the zones not inspected, (3) the limitations of visual inspections, (4) repair station resistance to the STC documentation, (5) mixing of wire types, and (6) wire life.

It will take nearly a decade from the 1996 explosion of TWA Flight 800 to the first zonal inspections in 2006. On the other hand, proponents say the program starts with the three most critical items. The first inspections will focus on cockpit, E&E and power feeder cable and wiring.

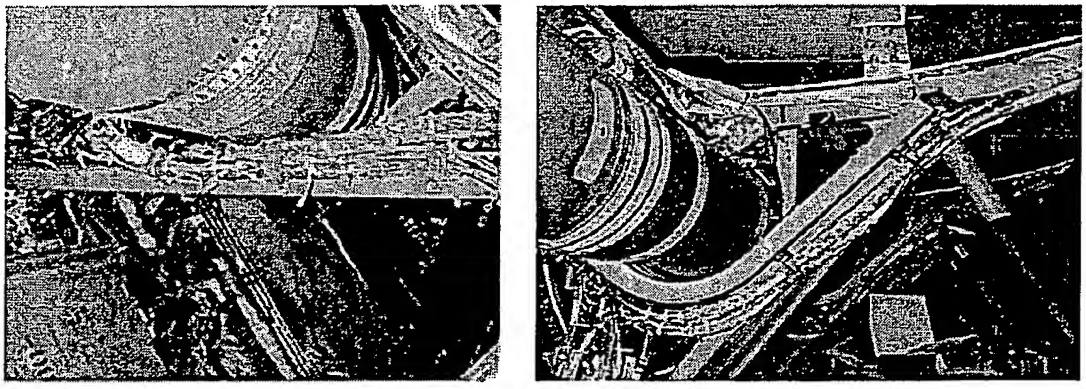
SFAR 88 already is in place to address fuel system safety. Dozens of ADs have been issued to correct other safety-related wiring deficiencies. More than half of the FAA's 1,500 inspectors have been trained to better police wiring practices and problems. In addition, the FAA now requires complete documentation for every wire that is part of an STC modification – where it originates, where it terminates.

Primary reliance remains on visual inspections, albeit enhanced to include mirrors. However, the basic limitation remains. It is a documented fact that visual inspections will catch only 20 to 25 percent of wiring flaws.

Furthermore, terminology problems remain. Expressions like "heavy current," "adequate separation" and "failure" need to be more precisely defined. There is the whole problem of single element dual load path (SEDLP) components, roughly described as the tube within a tube, and the obvious question: How does one inspect the inner tube? These components need to be identified by airplane, and decisions must be made as to how to inspect them.

Among the issues not raised is the question asked by former NTSB chairman Jim Hall during the TWA 800 investigation: Is there a life-limit to aircraft wiring? The tougher standards articulated last week for smoking, toxicity and so forth imply a longer service life, but the question of a life-limit related to a wire type's original rating specification seems to linger in sort of a twilight taboo zone. ✈

'When Wiring Failure Is Not an Option'
The Space Shuttle Approach



Before **After**

(Trayed, with larger bend radius and nil potential for chafing)

Shuttle mission STS-93 almost ended in calamity, when a wire short caused loss of AC Phase "A" power, which meant the vehicle came within a hairsbreadth of losing two of its three main engines. This event led to complete grounding of the orbiter fleet for the last half of 1999 while wiring in all four vehicles was subjected to intense examination. During the post-flight inspection of the fleet, over 3,000 wiring discrepancies were found and 64 serious wiring flaws were disclosed. Wiring runs were analyzed for any of the possible calamity-causing installation errors such as tight bend radii and chafing. Photographs above show the lengths to which NASA has gone to prevent a recurrence of the STS-93 event, or anything like it. *Sources: NASA, IASA*

ACCIDENTS AND INCIDENTS [1]				
DATE/SITE & INVEST. ID#	AIRCRAFT & REGISTRATION	CIRCUMSTANCES	DEATHS & INJURIES	PRELIMINARY ANALYSIS[2]
02 Jun 02 Asuncion Buenos Aires JFK	767-323ER of AA reg: N376AN Flt AA900	About 1 hour into flight, problems with #1 engine and a/c diverted to Asuncion, Paraguay.	Nil	Upon landing the engine suddenly caught fire but fire services were able to extinguish the flames immediately.
11 Jun 02 Brisbane - Darwin	737-800 of Virgin Blue Flt 467	Captain demoted as a result of an attempted cover-up of a runway overrun.	Nil / 92 pax and 7 crew	Failed to make go-round decision after landing long with a gusty tailwind.
28 Jun 02 Sydney A/P	Qantas believed to be 767	Heavy landing. Rwy 25 closed due to heavy landing by a Qantas jet on rwy 25. ATC advised: "Possible damage to runway, inspection required."	Nil	16R/34L also not available until inspected, as debris/damage littered intersection of 2 rwys. Fuel shortage caused an SQ a/c to divert Melbourne.
29 Jun 02 Brisbane A/P Qld Australia	Qantas BAe 146 (operated by National Jet)	Precautionary return to Brisbane due to cockpit smoke 10 mins out.	Nil	Upon arrival, maintenance checks determined it to be a faulty circuit breaker.
01 Jul 01 (eve) Boston Logan-Wilmington	DC-8-61 of Airborne Express Flt ABX387	On takeoff runway 22R, a/c struck its tail on the runway causing fuselage damage.	Nil	Takeoff was continued and aircraft proceeded to destination without further incident.
01 Jul 02 airways intersection 35,000ft above Lake Constance Germany	Bashkirian TU154 reg: V9 2927 DHL 757-200SF reg: A9C-DHL Serial no:22175	Collided in emergency descents as a result of single Zurich ATC controller overload, deficient ground-line comms and ATC's Short Term Collision Avoidance Radar Alert System being down for sched maint upgrade.	757: 2 crew TU154: 59 pax and 12 crew No survivors	Despite the DHL's "TCAS Descending" transmission, TU154 pilot decided to follow urgent ATC descent instruction given one second later - instead of TCAS Resolution Alert instruction to "Climb." Collision occurred 44 secs later and 600 ft. lower..
02 Jul 02 Miami - Phoenix	Airbus 319 America West Flight 556	Runway recall of two 737 pilots, then both arrested for being intoxicated in charge (.091 and .084 -both above Florida's legal limit of .08).	Nil/124 +8	In 1990 a NWA 727 pilot was jailed after three flight-crew were arrested on arrival Minneapolis. The FAA limit is .04.
02 Jul 02 1830L Buffalo Intl A/P	DC-9 of AirTran	After landing, left paved surface and became bogged.	Nil	Unknown
04 Jul 02 Bangui (Central African Republic) N'Djamena in Chad to Brazzaville (Congo)	707-320 of Prestige Airlines of the Congo reg: 9-XRIS owned by NewGomair	Fuel burn high due to gear stuck down (pins?) and fuel exhausted on finals after emerg diversion. However surviving FE said crew "may have dumped too much fuel" before attempting to land.	22 fatal / 17 pax and 8 crew Casualties on ground high, indeterminate.	Cargo of chili and onions. Went down in Bangui marketplace, suburb of Guitangola, 4km short of the runway. Chief Director of NewGomair died on board.
04 Jul 02 Minneapolis St Paul (Minn) - Gatwick (UK)	DC10 of North-Western Flt NW44	Flight abort. Inflight diversion back to JFK due to failure of 2 out of 3 onboard navigation systems.	Nil	Couldn't enter the MNPS with 2 Nav systems U/S. (Minimum Navigation Performance Specification Airspace)
04 Jul 02 over Ukraine Tel Aviv - Moscow	El Al's Israeli Airlines	Flight reported seeing a surface-to-air missile explosion as they flew over Ukraine, Israel's transport minister says.	Nil	"Missile launch" followed an attack at an El Al counter at LA airport in which a gunman killed two before security guards shot him dead. Ukrainian Defense Ministry spokesman, said the sighting "could be anything."
10 Jul 02 Basel - Hamburg	SAAB2000 of Swiss (former Crossair)	Diverted to Werneuchen (a General Aviation field) whilst enroute	Nil/16 pax and 4 crew	It is believed that the a/c was running low on fuel in frontal weather.

[1] Air carrier incidents or accidents, or other accidents involving serious failures or fatal injuries, investigated by National Transportation Safety Boards. [2] DISCLAIMER: The information obtained from these National Reports is preliminary, possibly incomplete, and may be supplemented by new findings of fact as the inquiry progresses. [3] A/P=Airport.

- Data compiled from national aviation authority documents. Preliminary analysis by John Sampson, director of aircraft, engineering & technical operations, International Aviation Safety Association.(IASA) www.iasa.com.au

• **Points to ponder.** With respect to wiring safety and the ATSRAC effort, these observations have been culled from various sources:

✔ **Future electrical strategies need to be considered.** Engine maker **Rolls Royce** is involved n a number of electric technology research programs, including a **European Union**-funded Power Optimized Aircraft project that began this past February. **Boeing** is talking of an all-electric (i.e., no hydraulics) airplane. These developments imply a need for greater electrical system redundancy due to wiring bundle vulnerabilities. Not just wiring, but aircraft electrical systems in their broadest sense may become a Damocles sword hanging over future high-technology developments.

✔ **Does the airline industry need its own Adm. Hyman Rickover?** The late admiral was father of the nuclear Navy, yet during World War II he served effectively as head of the Bureau of Ships electrical section. Rickover earned his 1929 Master's Degree in electrical engineering from **Columbia University** and applied his skills, like **National Aeronautics and Space Administration** (NASA) engineeers today, to making his vessels electrically "sound." Until Rickover insisted upon 100 percent electrical integrity, the greatest threat faced by submariners in the pre-nuclear power era was from unstable electrics, susceptible wiring and deadly fumes from chlorine batteries. As the source who shared this historical anecdote suggested, "I think the airline industry needs its own Hyman Rickover.

✔ **Guaranteed survival solutions.** The regulators should try and focus on the fact that there is nothing as harmless as a dead (unpowered) wire. It will not burn, produce toxins, arc-track or propagate fire. If the arc fault circuit interrupter (AFCI) becomes a reality, its protections might best be backed up by fallback redundancy. It is in the area of redundancy where a little cunning engineering can pay dividends, offering guaranteed survival solutions. In aviation, incidents will continue to happen. They become accidents when crews are rapidly cornered and left without options or escape routes.

✔ **Acronym watch.** Consider the number of acronyms bruited about during last week's ATSRAC deliberations – EWIS, SEDLP, GVI. One skeptic suggested being alert to nascent tokenism whenever the acronyms proliferate and the hyperbole ("enhanced inspections") is embraced. ■

• **Booted for imbibing.** The two pilots who failed a breathalyzer test after being pulled back to the terminal at Miami have been fired by **America West Airlines** *(see related page 9 entry)*. The incident was a "wake up call," said Barry Sweedler, president of the **International Council on Alcohol, Drugs and Traffic Safety**. Sweedler also is former chief of safety recommendations for the **National Transportation Safety Board**. More needs to be done regarding alcohol abuse among aircrews, Sweedler maintained. At our invitation ("What do you recommend?"), Sweedler offered these thoughts:

"There are still a number of steps that need to be taken. Generally, there is a good framework in place. But here are a few things that might be considered. The FAA now checks a pilots driving history by using the National Driver Register to check for DWI [driving while intoxicated] when the pilot applies for a medical certification (an old NTSB Recommendation). Quite a few matches are made each year. The FAA can then take a closer look at those pilots with a DWI. If there are multiple DWIs they generally will not issue a certificate-without assurances that the pilot does not have an alcohol problem. An extra step might be to check criminal records for other types of alcohol or drug abuses. It appears that one of the Miami pilots had an alcohol domestic problem that might have given the FAA a clue that he needed to be looked at a bit more closely. I recall a few years ago, a Connecticut pilot had a domestic abuse problem that had not been detected. I think there was a proposal to check criminal records, but it may not have gone anywhere.

"After the Northwest situation in 1990, the FAA developed a pocket-sized booklet that gave all FAA inspectors guidelines about what to do if they are advised of possible pilots under the influence. I wonder if current inspectors had that booklet and if it should be updated and reissued. We did not have the TSA at that time. I noted that the FAA was not even involved in the Miami incident. It went from the TSA to the local police. Where was the FAA? Should they have been involved? They have numerous people at Miami. Could they have intervened more quickly?

"At least, the FAA should take a look at the current system for preventing pilots under the influence from flying. They may find their procedures and methods are OK. Or they find a few updates and changes are required. I just do not think they should walk away from this without a review. They get upset when they are accused of 'regulating by counting tombstones.' But if they do not take wakeup calls like this seriously and wait for an actual crash before they act, then the accusation is justified." >> *Sweedler, e-mail sweedlb@hotmail.com* << ■